Class Trentepohliophyceae

G.C. Zuccarello & J.M. Lopez-Bautista

The Trentepohliophyceae comprise one order (Trentepohliales) and one family (Trentepohliaceae) containing six genera and about 63 species. They share a suite of ecological, morphological and cytological characters that clearly distinguish them from other classes of green algae. All are subaerial (growing on humid soil, rocks, bark and leaves), some are endophytic (and possibly parasitic) on leaves and some occur as phycobionts in lichens (Matthews *et al*., 1989). Their endophytic or parasitic growth on leaves of vascular plants makes the group of some economic importance. The genus *Cephaleuros* is common on the leaves of tea, coffee, pepper and cocoa and can cause necrosis of epidermal and subepidermal leaf cells (Holcomb, 1986; Chakravarty & Mishra, 1983; Thompson & Wujek, 1997). Though the group is widespread and economically important, many basic biological questions remain unanswered.

The main diagnostic features of the class are its differentiated reproductive cells (which differ from vegetative cells); unique flagellar apparatus; and red-orange appearance due to the presence of large amounts of beta-carotene and other accessory pigments (i.e. astaxanthin).

Thalli are filamentous (uniseriate, branched) or form prostrate disks. Cells are uni- or multi-nucleate with several parietal discoid or band-shaped plastids and no pyrenoids. Flagellated biflagellate gametes and quadri-flagellate zoospores are produced in specialised, often urn-shaped, gametangia or zoosporangia. Flagellated cells are dorsiventrally compressed, lack an eyespot and have a unique configuration of the flagellar root of the basal body. The overlapping basal bodies have a counter-clockwise configuration (termed 11 o'clock – 5 o'clock) and four microtubular roots. 'Columnar structures' subtend the microtubular roots and superficially resemble the multi-layered structures of the Charophyceae, although careful examination shows differences (Graham, 1984).

The class has closed mitosis and cytokinesis with persistent interzonal spindles and membrane vescicles forming a cell plate. The persistent spindles lead to the formation of plasmodesmata, similar to plasmodesmata in some Charophyceae.

Life cycles in Trentepohliophyceae are not well documented. Those of *Cephaleuros* and *Stomatochroon* have been reported as an alternation of heteromorphic generations (Thompson, 1961; Thompson & Wujek, 1997), whereas *Trentepohlia* and *Phycopeltis*are thought to have an isomorphic alternation of generations (Chapman, 1984). Even this area of the basic biology of these organisms is still unclear.

Characteristics of Trentepohliophyceae

Cell covering: wall of polysaccharides, sporopollenin-like material found in some genera

Flagellar arrangement: Zoids with 2 or 4 flagella; cruciate-type of root system with 4 microtubular roots, 'columnar structures' subtending microtubular roots; counter-clockwise 11 o'clock – 5 o'clock basal body configuration with distinct overlap

Mitosis/cytokinesis: closed mitosis; spindle persistent; septum formed within a phragmoplast; plasmodesmata present

Body plan: branched filamentous, occasionally heterotrichous; prostrate discoid

Sexual life cycle: diplohaplontic, iso- or heteromorphic

Distribution: subaerial habitats; some obligate epiphytes (possibly parasites); mostly tropical to warm temperate

Six genera are presently recognised (*Cephaleuros Physolinum Phycopeltis*, *Printzina Trentepohlia*and *Stomatochroon*), *Trentepohlia* being the most diverse with 36 species. *Cephaleuros* (13 species) and *Phycopeltis* (12 species) have been recorded from Australia but most reports are of *Trentepohlia*, mainly from Queensland (Day *et al*., 1995). Many new species and varieties have been reported from Queensland (Cribb, 1958, 1971, 1986), though environmental factors which may affect morphological characters have not been studied. There has been a general lack of taxonomic investigation of these organisms as they are classified as neither freshwater nor marine algae and few have been interested in their study.

References

Chakravarty, P. & Mishra, R.R. (1983), Studies in forest pathology, 5, Host range of *Cephaleuros virescens* and the biochemical changes of the infected leaves, *Eur. J. Forest Pathol.* 13: 109–115.

Chapman, R.L. (1984), An assessment of the current state of our knowledge of the Trentepohliaceae, pp. 233–250, *in* D.Irvine & D.Johns (eds), *Systematics of the Green Algae*. Academic Press, London.

Cribb, A.B. (1958), The genus *Trentepohlia* in south-eastern Australia, *Pap. Dept. Bot. Univ. Queensland* 3(20): 193–197.

Cribb, A.B. (1971), Some Trentepohliaceous algae from Carnarvon Gorge, *Queensland Naturalist* 20: 90–91.

Cribb, A.B. (1986), Some algae from Kroombit Tops, Queensland, *Queensland Naturalist* 27: 24–26.

Day, S.A., Wickham, R.P., Entwisle, T.J. & Tyler, P.A. (1995), *Bibliographic Checklist of the Non-marine Algae of Australia*. Flora of Australia Supplementary Series no. 4. Australian Biological Resources Study, Canberra.

Graham, L.E. (1984), An ultrastructural re-examination of putative multi-layered structures in *Trentepohlia aurea*, *Protoplasma* 123: 1–7.

Holcomb, G.E. (1986), Hosts of the parasitic alga *Cephaleuros virescens* in Louisiana and new host records for the continental United States, *Pl. Dis.* 70: 1080–1083.

Matthews, S.W., Tucker, S.C. & Chapman, R.L. (1989). Ultrastructural features of mycobionts and trentepohliaceous phycobionts in selected subtropical crustose lichens, *Bot. Gaz.* 150: 417–438.

Thompson, R. H. 1961. The life cycles of *Cephaleuros* and *Stomatochroon*. Proc. 9th Int. Bot. Congr. 2.: 397

Thompson, R.H. & Wujek, D. (1997), *Trentepohliales: Cephaleuros, Phycopeltis, and Stomatochroon. Morphology, Taxonomy, and Ecology*. Science Publishers, India.